

The appropriateness of colonoscopy: a multi-center, international, observational study

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Abstract

Objective. To examine the appropriateness and necessity of colonoscopy across Europe.

Design. Prospective observational study.

Setting. A total of 21 gastrointestinal centers from 11 countries.

Participants. Consecutive patients referred for colonoscopy at each center.

Intervention. Appropriateness criteria developed by the European Panel on the Appropriateness of Gastrointestinal Endoscopy, using the RAND appropriateness method, were used to assess the appropriateness of colonoscopy.

Main outcome measure. Appropriateness of colonoscopy.

Results. A total of 5213 of 6004 (86.8%) patients who underwent diagnostic colonoscopy and had an appropriateness rating were included in this study. According to the criteria, 20, 26, 27, or 27% of colonoscopies were judged to be necessary, appropriate, uncertain, or inappropriate, respectively. Older patients and those with a major illness were more likely to have an appropriate or necessary indication for colonoscopy as compared to healthy patients or patients who were 45–54 years old. As compared to screening patients, patients who underwent colonoscopy for iron-deficiency anemia [OR: 30.84, 95% CI: 19.79–48.06] or change in bowel habits [OR: 3.69, 95% CI: 2.74–4.96] were more likely to have an appropriate or necessary indication, whereas patients who underwent colonoscopy for abdominal pain [OR: 0.64, 95% CI: 0.49–0.83] or chronic diarrhea [OR: 0.54, 95% CI: 0.40–0.75] were less likely to have an appropriate or necessary indication.

Conclusions. This study identified significant proportions of inappropriate colonoscopies. Prospective use of the criteria by physicians referring for or performing colonoscopies may improve appropriateness and quality of care, especially in younger patients and in patients with nonspecific symptoms.

Keywords: appropriateness of care, colonoscopy, expert panel, health services research, practice guidelines, RAND appropriateness method

Introduction

Given the current increasing need for cost containment and the necessity to ensure high-quality care, the appropriate use of medical procedures, including colonoscopy, is crucial. Appropriateness criteria for medical procedures based on evidence of effectiveness, side effects, and consequences are a way to improve the quality of care. Ideally, the effectiveness of medical procedures should be assessed in randomized controlled trials. However, evidence from such trials is often

not available or cannot provide sufficient detail for application to a wide range of situations occurring in real life [1], thereby creating a gap between evidence-based medicine and actual clinical practice.

The RAND appropriateness method aims to bridge this gap by combining the best available scientific evidence with the judgment of a multidisciplinary expert panel, in order to rate the appropriateness of medical procedures [2–4]. The RAND method has been widely used and accepted for many different medical procedures, ranging from carotid

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endarterectomy and coronary angiography to upper gastrointestinal endoscopy and colonoscopy [4–6].

Using the RAND method, the European Panel on the Appropriateness of Gastrointestinal Endoscopy (EPAGE) produced a list of detailed and explicit appropriateness criteria for colonoscopy that is freely available to physicians via a website (www.epage.ch) [7]. By applying these criteria to actual patients seen in clinical practices from multiple countries, a true reflection of the appropriateness of use of colonoscopy can be revealed. The objective of this study was therefore to examine the appropriateness of colonoscopy performed in clinical practices internationally.

Methods

This observational study prospectively included consecutive patients referred for colonoscopy between December 2000 and February 2002 from 21 centers in 10 European countries (Czech Republic, Denmark, France, Germany, Great Britain, Italy, Poland, Spain, Sweden, Switzerland) and Canada. The centers included were a convenience sample based on personal contacts in well-known endoscopy centers. Each center was requested to include approximately 300 patients in order to obtain a large-enough sample size for descriptive purposes. Data concerning patients and colonoscopies were collected through the use of patient-specific questionnaires completed by the endoscopists. Necessary ethics approval, according to country-specific regulations, was obtained prior to commencement of the study.

European panel on the appropriateness of gastrointestinal endoscopy

A detailed explanation of the RAND method used to create the EPAGE criteria can be found elsewhere [6].

In 1998, EPAGE evaluated the appropriateness and necessity of colonoscopy using the RAND appropriateness method [6]. The panel was composed of 14 experts from Denmark, France, Germany, Great Britain, Italy, the Netherlands, Norway, Spain, and Switzerland and included 8 gastroenterologists, 4 general practitioners or internists, and 2 surgeons [6]. All members of this international multidisciplinary expert panel were involved in the referral for, or performance of gastrointestinal endoscopy, and they were selected with the assistance of National and European societies representing their specialties [6].

A detailed search of the literature was undertaken in order to identify all possible clinical scenarios or indications for which colonoscopy might be used or proposed. This indication list, along with the literature review, was sent to each member of the multidisciplinary international expert panel who could add to the listed indications if needed and who independently rated each indication for its appropriateness on a nine-point scale (1 = extremely inappropriate, 9 = extremely appropriate) [6]. A colonoscopy was defined as being appropriate if the expected health benefits outweighed the expected negative consequences by a sufficiently wide

margin that the procedure was worth doing [2]. Indications that were deemed appropriate were submitted to a further rating to determine necessity. A colonoscopy was defined as being necessary if the benefits were so significant that colonoscopy was the only ethical choice [3].

The panel's first round of appropriateness ratings was tabulated and distributed to the panel members so that they could compare their results with the results of the other panelists [6]. Following discussions between panel members about the differences between indication ratings, a second round of rating was conducted. The results of the second assessment were used to determine the appropriateness and necessity of each indication for colonoscopy [6]. The appropriateness categories were formulated using the median value and the degree of agreement among the panelists. Indications were considered appropriate if the median rating was between 7 and 9 without disagreement and inappropriate if the median was between 1 and 3 without disagreement. Indications with a median between 4 and 6, or those with clear disagreement, were considered uncertain. Disagreement was defined as occurring when at least four panelists rated an indication from 1 to 3 and four others from 7 to 9. Indications that were deemed appropriate were submitted to a further rating to determine necessity. Indications with a median necessity rating between 7 and 9 without disagreement were considered necessary.

The final indication list contained 8 major clinical categories and 309 individual indications. Each indication had sufficient detail to form a reasonably homogeneous group of patients, and contained all information experts believed they needed to determine whether the indication for colonoscopy was appropriate or necessary, including, for example, family and medical history, previous pathology, age, and health status.

Patient characteristics

Patient characteristics examined included demographics, health status, and patient status. Health status was classified using the ASA Physical Status Classification into three categories: healthy (class I), minor illness (class II), and major illness (class III–V) [8]. Indication for colonoscopy was determined through the use of the above-mentioned criteria (www.epage.ch), and classified into main indication categories according to the main and most severe clinical symptom.

Other aspects of colonoscopy, including colon cleansing, diagnostic yield, patient tolerance and satisfaction, screening colonoscopy, variations in practice patterns, and factors associated with technical performance, are examined in more detail in separate papers [9–13].

Statistics

Descriptive and exploratory analyses examining the distribution of patient characteristics among the four appropriateness categories were conducted. Multiple variable logistic regression analyses were used to examine the association between patient characteristics and appropriate or necessary

indications as compared to inappropriate or uncertain indications, while controlling for the centers patients were from. Variables were included based on the statistical significance of the variable as a whole, using forward and backwards stepwise selection. Statistical significance was defined as $P < 0.05$. All statistical analyses were conducted using Stata for Windows version 9.1 (StataCorp, College Station, TX, USA).

Results

Of the initial 6004 patients referred for colonoscopy, 5213 (86.8%) patients were included in this study. Three hundred sixty-five (6.1%) patients were excluded because the main purpose of their colonoscopy was therapeutic, and 426 (7.1%) patients were excluded because they did not have an EPAGE appropriateness rating. Indications were not covered by the criteria because of missing information, or because the clinical scenario of the patient was not evaluated as an indication for colonoscopy by the panel, for example, colonoscopy was performed to search for a primary tumor in a patient with metastatic adenocarcinoma or to search for a source of septicemia.

Center, patient, and procedure characteristics are presented in detail elsewhere [9–13]. Just over half of the patients were female and the average age was 57.4 years old. Forty-four percent of the patients had good health, while 33% had a minor illness and 23% had a major illness. The three most common indication categories for colonoscopy were surveillance after polypectomy or colorectal cancer resection, hematochezia, and abdominal pain.

Of the 309 possible indications for colonoscopy, 253 (81.9%) indications were actually seen in this study. The number of EPAGE indications for colonoscopy seen and the total number of possible indications, by main indication category can be seen in Table 1. Descriptions of the 10 most common indications seen are listed in Appendix and accounted for 33.2% of patients. Half of the patients included in this study were covered by 20 different indications, and 75% of the patients were covered by 50 indications. The remaining 25% of patients were covered by 183 indications, of which none of the indications had more than 25 patients, and 166 indications had less than 10 patients.

Of the 5213 patients included in this study, 1413 (27.1%; 88 indications) had an inappropriate indication, 1409 (27.0%; 56 indications) had an uncertain indication, 1359 (26.1%; 70 indications) had an appropriate indication, and 1032 (19.8%; 39 indications) had a necessary indication. The proportion of patients with a necessary indication ranged from 6.5 and 34.3% between the 21 centers included in this study. The proportion of patients with an appropriate indication ranged from 15.2 to 35.6%, while patients with an uncertain indication ranged from 16.2 to 35.9%, and patients with an inappropriate indication ranged from 12.3 to 43.4%.

The distribution of the appropriateness ratings according to patient characteristics can be seen in Table 2. Approximately half of patients under the age of 45 years had

Table 1 The number of EPAGE indications for colonoscopy that were seen in this study and the total number of possible indications, by main indication category

	Indications seen	Total possible indications
Main indication category		
Screening for colorectal cancer in asymptomatic patients	27	37
Surveillance post-resection of polyps or colorectal cancer	28	29
Hematochezia	26	28
Abdominal pain	31	36
Known inflammatory bowel disease	46	59
Diarrhea	28	38
Iron-deficiency anemia	30	39
Change in bowel habits (predominantly constipation)	17	18
Other indications ^a	20	25
Total	253	309

^aOther indications include: lesion found at a recent barium enema or sigmoidoscopy, positive recent fecal occult blood test, unexplained weight loss, preoperative colonoscopy, endometriosis, and miscellaneous.

an inappropriate indication, while over half of the patients over the age of 65 years had an appropriate or necessary indication. The highest rate of patients with necessary indications occurred among patients who underwent colonoscopy for other indications (80.0%) or iron-deficiency anemia (77.2%). About half of the patients who had colonoscopy for change in bowel habits, known inflammatory bowel disease or surveillance had an appropriate or necessary indication, while over half of the patients who had colonoscopy for screening had an uncertain indication. Inappropriateness rates were highest among patients who had colonoscopy for abdominal pain, chronic diarrhea, or surveillance.

The determinants of having an appropriate or necessary indication are shown in Table 3. While adjusting for center, it was found that patients with major health problems were more likely than healthy patients to have an appropriate or necessary indication. As compared to patients who were 45–54 years old, younger patients were less likely to have an appropriate or necessary indication, while older were more likely to have an appropriate or necessary indication. Furthermore, patients who underwent colonoscopy for an indication of other or iron-deficiency anemia were over 20 times more likely to have an appropriate or necessary indication than patients who underwent colonoscopy for screening. Similarly, patients with indications of change in bowel habits, known inflammatory bowel disease, or surveillance were more likely to have an appropriate or necessary

Table 2 The distribution of appropriateness by patient and center characteristics

Patient characteristics	Appropriateness category, <i>n</i> (%)				Total ^a
	Inappropriate	Uncertain	Appropriate	Necessary	
<hr/>					
Main indication category					
Screening for colorectal cancer in asymptomatic patients	80 (13.3)	336 (56.0)	99 (16.5)	85 (14.2)	600
Surveillance post-resection of polyps or colorectal cancer	389 (38.7)	115 (11.5)	339 (33.8)	161 (16.0)	1004
Hematochezia	263 (29.2)	375 (41.6)	232 (25.8)	31 (3.4)	901
Abdominal pain	259 (38.0)	259 (38.0)	164 (24.0)	0 (0.0)	682
Known inflammatory bowel disease	149 (34.8)	63 (14.7)	198 (46.3)	18 (4.2)	428
Diarrhea	159 (38.6)	175 (42.5)	78 (18.9)	0 (0.0)	412
Iron-deficiency anemia	24 (6.2)	3 (0.8)	61 (15.8)	299 (77.2)	387
Change in bowel habits (predominantly constipation)	70 (20.0)	57 (16.3)	144 (41.1)	79 (22.6)	350
Other indications ^b	20 (4.4)	26 (5.8)	44 (9.8)	359 (80.0)	449
Gender					
Male	681 (27.3)	634 (25.5)	682 (27.4)	492 (19.8)	2489
Female	732 (26.9)	775 (28.4)	677 (24.9)	540 (19.8)	2724
Age category					
<34 years	241 (48.7)	97 (19.6)	132 (26.7)	25 (5.0)	495
35–44 years	334 (51.2)	124 (19.0)	134 (20.5)	61 (9.3)	653
45–54 years	330 (32.7)	293 (29.0)	222 (22.0)	165 (16.3)	1010
55–64 years	206 (18.0)	390 (34.0)	327 (28.5)	224 (19.5)	1147
65–74 years	190 (17.2)	308 (28.0)	332 (30.1)	272 (24.7)	1102
>75 years	112 (13.9)	197 (24.4)	212 (26.3)	285 (35.4)	806
Health status					
Healthy	751 (32.7)	638 (27.7)	563 (24.5)	347 (15.1)	2299
Minor problem	438 (25.4)	497 (28.9)	455 (26.4)	333 (19.3)	1723
Major problem	224 (18.8)	274 (23.0)	341 (28.6)	352 (29.6)	1191
Type of patient					
Inpatient	207 (18.0)	287 (25.0)	311 (27.0)	345 (30.0)	1150
Day-case	255 (26.3)	295 (30.4)	234 (24.1)	186 (19.2)	970
Outpatient	938 (30.9)	809 (26.6)	799 (26.3)	492 (16.2)	3038
Total	1413 (27.1)	1409 (27.0)	1359 (26.1)	1032 (19.8)	5213

^aTotal may not add to 5213 because of missing value.

^bOther indications include: lesion found at a recent barium enema or sigmoidoscopy, positive recent fecal occult blood test, unexplained weight loss, preoperative colonoscopy, endometriosis, and miscellaneous.

indication than screening patients. Conversely, patients with indications of abdominal pain or chronic diarrhea were less likely to have an appropriate or necessary indication than screening patients.

Discussion

This study, using explicit and detailed criteria, examined the appropriateness of colonoscopy performed at endoscopy centers internationally. The criteria could be applied to most of the consecutive patients referred for colonoscopy. Colonoscopy was judged to be necessary, appropriate, uncertain, or inappropriate in 20, 26, 27, or 27% of patients,

respectively. Patients who were older than 54 years or who had a major illness were more likely to have an appropriate or necessary indication for colonoscopy than patients who were 45–54 years old or who were healthy. As compared to screening patients, patients who underwent colonoscopy for iron-deficiency anemia, change in bowel habits, known inflammatory bowel disease, surveillance or other indications were more likely to have an appropriate or necessary indication, while patients who underwent colonoscopy for abdominal pain or chronic diarrhea were less likely to have an appropriate or necessary indication.

There are a few limitations to this study. Firstly, while the RAND appropriateness method is widely used and accepted for many different medical procedures [4–6], it is not

Table 3 The adjusted odds ratios of having an appropriate or necessary indication in patients undergoing a diagnostic colonoscopy^a

Patient characteristic	OR ^b	95% CI	P
Main indication category			
Screening for colorectal cancer in asymptomatic patients	1.00		
Surveillance post-resection of polyps or colorectal cancer	1.92	1.53–2.42	<0.01
Hematochezia	1.03	0.81–1.31	0.81
Abdominal pain	0.64	0.49–0.83	<0.01
Known inflammatory bowel disease	3.23	2.43–4.30	<0.01
Diarrhea	0.54	0.40–0.75	<0.01
Iron-deficiency anemia	30.84	19.79–48.06	<0.01
Change in bowel habits (predominantly constipation)	3.69	2.74–4.96	<0.01
Other indications ^c	20.91	14.54–30.10	<0.01
Gender			
Male	1.00		
Female	0.90	0.79–1.03	0.12
Age			
<34 years	0.68	0.52–0.89	<0.01
35–44 years	0.62	0.48–0.79	<0.01
45–54 years	1.00		
55–64 years	1.47	1.21–1.79	<0.01
65–74 years	1.68	1.37–2.07	<0.01
>75 years	1.75	1.38–2.21	<0.01
Health status			
Healthy	1.00		
Minor problem	0.95	0.81–1.12	0.54
Major problem	1.23	1.01–1.49	0.04

OR, odds ratio; 95% CI, 95% confidence interval.

^aBased on a total sample size of 5213 patients and 2391 (45.9%) patients with appropriate and/or necessary indications.

^bOdds ratios are adjusted for the other variables included in the table and for the center the patient was from.

^cOther indications include: lesion found at a recent barium enema or sigmoidoscopy, positive recent fecal occult blood test, unexplained weight loss, preoperative colonoscopy, endometriosis, and miscellaneous.

perfect and thus, should be regarded as recommendations only, and not as prescriptive rules. Despite its limitations, panel-based appropriateness ratings provide one of the best, available means of bridging the gap between evidence-based medicine and clinical practice, and should therefore be regarded as a helpful decision-making tool [1, 14]. Secondly, although the study of 21 centers from 11 countries provided a wide range of patients from a wide range of settings, the sample of centers examined in this study was a convenience sample and may therefore not be representative of all endoscopy centers and all patients undergoing colonoscopy. Thirdly, even though all patients who underwent colonoscopy were to be consecutively included in the study and data completeness was asked of all participating centers, it is possible that not all colonoscopy patients were included. However, the inclusion period of each center was in agreement with their reported annual volume of colonoscopies, indicating that most, if not all, patients who underwent colonoscopy were included in the study. Lastly, only one or two centers were examined from each country, and country-specific results could therefore not be reported due to

confidentiality issues and because they may not have been representative of each country.

The appropriateness of colonoscopy has been assessed in several studies [15–22]. Rates of inappropriateness between 14 and 37% have been described in the literature [15–19, 21, 22]. This is in line with one quarter of patients with an inappropriate indication found in this study. Inappropriateness rates vary among studies according to the type of appropriateness criteria used and the type of patients evaluated, thus direct comparisons are difficult [15–19, 21].

Almost half of the patients seen in this study had indications for colonoscopy that were deemed appropriate or necessary by the EPAGE criteria. This is lower than the proportion of appropriate or necessary indications found in previous researches, which ranged between 58 and 64% [16, 17]. However, when the proportion of appropriate or necessary and uncertain indications was examined together, 73% of patients were included, which is similar to that found in previous studies. Previous researches have shown that the proportion of patients with uncertain or appropriate indications ranged between 69 and 80%, depending on the

appropriateness criteria used [16–20]. The discrepancy between the amount of appropriate indications seen in this study and others may be explained in part by the distribution of the main indication categories encountered. Over 11% of patients in this study had a colonoscopy for screening compared to 3–8% in previous studies [16, 19]. Over half of the screening patients from this study had an uncertain indication, resulting in a larger proportion of patients with uncertain indications than in other studies. The use, appropriateness and diagnostic yield of screening colonoscopy can be found in detail elsewhere [9].

Around 80% of the patients with an indication for colonoscopy of iron-deficiency anemia or ‘other’ had a necessary indication. This means that for most patients with an indication of iron-deficiency anemia or ‘other’, the benefits of colonoscopy not only outweighed the consequences but also they were so significant that colonoscopy was the only ethical choice, according to the criteria developed by the EPAGE panel. Furthermore, patients with these two indications were over 20 times more likely to have an appropriate or necessary indication as compared to screening patients. The ‘other’ indication category included patients with a lesion detected at a recent barium enema or sigmoidoscopy, as well as patients with a positive fecal occult blood test. These indications are almost always appropriate because all positive preliminary colorectal cancer tests lead to colonoscopy for the definitive identification and removal of adenomas and early cancers [23]. Similarly, iron-deficiency anemia was almost always appropriate for colonoscopy, because it is a common initial presentation of colorectal cancer, and colonoscopy is the gold standard for the diagnosis of colorectal cancer [24].

The largest proportion of patients with indications deemed inappropriate was in the main indication category of surveillance colonoscopy post-polypectomy or post-resection of colorectal cancer. The majority of these indications were deemed inappropriate because the time interval was too short between the current surveillance colonoscopy and the polypectomy, resection of colorectal cancer, or previous surveillance colonoscopy. The EPAGE criteria, as well as other guidelines, based on the results of randomized clinical trials, recommend >3 years between surveillance colonoscopies [25–27]; hence colonoscopies that occurred in <3 years were deemed inappropriate. However, when examined the multiple variable model, patients with a surveillance indication were more likely to have an appropriate or necessary indication than screening patients.

Patients with an indication for colonoscopy of abdominal pain or diarrhea were less likely to have an appropriate or necessary indication than screening patients. This may be because abdominal pain and diarrhea are nonspecific symptoms, which are often inappropriate for colonoscopy since other investigative methods should be used first, in order to exclude other diagnoses. Additionally, the high inappropriateness rate among patients with abdominal pain and diarrhea indicates that colonoscopy may be overused in these patients. Overuse of medical procedures is a critical issue if quality of medical care is to be maintained or enhanced in a climate of cost containment [15, 17].

Another category of patients in whom colonoscopy may be overused is patients with the age of less than 45 years. Guidelines suggest that screening should be offered for colorectal cancer and adenomatous polyps beginning at age 50 [27]. Thus, using this age category as the standard, it was found that patients younger than 45 years were less likely to have an appropriate or necessary indication for colonoscopy. Approximately half of patients with the age of <45 years had an inappropriate indication for colonoscopy. Unless a patient with the age of <45 years is at an increased risk of developing colorectal cancer or has specific symptoms, colonoscopy may not be the most appropriate procedure.

Use of the EPAGE appropriateness criteria may be a way to decrease the overuse of colonoscopy, especially in younger patients and patients with nonspecific symptoms. The explicit and detailed criteria provide physicians guidance as to when colonoscopy should be most appropriately used. Although previous research has shown that strict adherence to the criteria would lead to missed diagnoses, it has been found that patients with an appropriate indication are more likely to have a significant diagnosis at colonoscopy than patients with an inappropriate indication, which is an important parameter in judging the validity [12]. This suggests that the use of the criteria to screen for appropriateness may not only decrease the overuse of colonoscopy, but may also increase the diagnostic yield of colonoscopy, thereby improving the quality of care [12]. However, the guidelines are merely meant to aid physicians in their decision-making and help enhance the quality of care. Owing to the complex nuances of the multiple factors involved in determining suitable medical care, they cannot replace physician’s clinical judgment. However, precisely because of their detailed nature, the criteria seem to capture many of these complex nuances and have been found useful by clinicians [28]. Future research needs to be completed to specifically examine the effects of not performing colonoscopy for inappropriate indications.

It has been suggested [29] that it is appropriate to perform a colonoscopy on any patient who has never had a colonoscopy, regardless of the reason, whether for symptoms or for screening. This would relegate appropriateness criteria only to assessing repeat colonoscopies. Such an attitude would, obviously, modify the percentage of inappropriate colonoscopies in our study. However, we feel that the attitude proposed by Andriulli *et al.* would be irresponsible. Many uninformative and unnecessary procedures with normal findings would result and resources would be diverted away from other, necessary healthcare, including, for example, resources to implement a rigorous program of colorectal cancer screening, based on explicit criteria [30].

In conclusion, over a quarter of colonoscopies conducted in multiple centers internationally were inappropriate, suggesting overuse of colonoscopy. In today’s climate of cost containment, appropriate use of medical procedures is necessary to ensure high-quality care. The use of the detailed and explicit EPAGE appropriateness criteria especially in younger patients and in patients with nonspecific symptoms, such as abdominal pain and diarrhea, may decrease overuse and increase quality of care. These criteria are freely available on the Internet

(www.epage.ch), and by responding to six or fewer questions concerning the patient, physicians will immediately obtain the detailed results of the expert panel evaluation.

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Appendix

The 10 most frequent indications for colonoscopy seen in this study ($n = 1733$, 33.2%).

- (1) Hematochezia (bright red blood) in a hemodynamically stable patient of 50 years old or older without known inflammatory bowel disease and with no known risk factors for colorectal cancer. The patient has had no previous lower gastrointestinal investigation (sigmoidoscopy, anoscopy, or barium enema) done. According to the expert panel rating, this indication was uncertain ($n = 322$, 6.2%).
- (2) A 50-years-old or older patient with iron-deficiency anemia (malabsorption syndrome excluded) with no current abdominal symptoms and no previous lower gastrointestinal investigation done. According to the expert panel rating, this indication was appropriate and necessary ($n = 230$, 4.4%).
- (3) Same as 1 (above), but patient aged <50 years. According to the expert panel rating, this indication was inappropriate ($n = 191$, 3.7%).
- (4) Surveillance following colonoscopic polypectomy (excludes familial polyposis and non-polyposis hereditary colorectal cancer) in a patient with no colonoscopy since polypectomy and a previously clean colon. The patient's last colonoscopy was 1 to <3 years previously. According to the expert panel rating, this indication was inappropriate ($n = 165$, 3.2%).
- (5) Screening for colorectal cancer in an asymptomatic patient, 40 years old or older, without a personal history of colorectal cancer or polyps, who is at slight risk of colorectal cancer (adenomatous polyps or colorectal cancer in one first-degree relative, or adenomatous polyps or colorectal cancer in two second-degree relatives, or history of breast, ovarian, or endometrial cancer in patient or one first-degree relative). The patient has had no previous colonoscopy. According to the expert panel rating, this indication was uncertain ($n = 150$, 2.9%).
- (6) Change in bowel habits (predominantly constipation), of at least 2 months duration, without known inflammatory bowel disease, without anemia or fecal occult blood positive stools and without pain. In a 50-years-old or older patient who has no risk factors for colorectal cancer and has had no previous lower gastrointestinal investigation and no previous therapy. According to the expert panel rating, this indication was appropriate ($n = 144$, 2.8%).
- (7) Uncomplicated lower abdominal pain of at least 2 months duration, without known inflammatory bowel disease, without anemia and without fecal occult blood positive stools. In a 50-years-old or older patient experiencing pain only, who has no risk factors for colorectal cancer and has had no irritable bowel syndrome therapy and no previous lower gastrointestinal investigation. According to the expert panel rating, this indication was uncertain ($n = 139$, 2.7%).
- (8) Surveillance following curative intent resection of colorectal cancer in a patient who has had no colonoscopy since resection. The time since the resection was 1 to <3 years previously. According to the expert panel rating, this indication was uncertain ($n = 137$, 2.6%).
- (9) Patient with any lesion, except diverticulitis, found at most recent barium enema or sigmoidoscopy and not evaluated by colonoscopy. According to the expert panel rating, this indication was appropriate and necessary ($n = 134$, 2.6%).
- (10) Uncomplicated lower abdominal pain of at least 2 months duration, without known inflammatory bowel disease, without anemia and without fecal occult blood positive stools. In a 50-years old or older patient experiencing both pain and change in bowel habits (predominantly constipation) who has no risk factors for colorectal cancer and has had no irritable bowel syndrome therapy and no lower gastrointestinal investigation. According to the expert panel rating, this indication was appropriate ($n = 121$, 2.3%).

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